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Response To Comments On:

"Statewide Greenhouse Gas Emissions Level: 1990 Baseline and 2020 Business as Usual Projection"

Regulatory Authority:
MGL Chapter 21N, Section 3

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I. Introduction

In response to overwhelming scientific evidence that climate change is occurring as a result of human-created emissions of greenhouse gases (GHGs), and that these changes pose significant threats to public health and the environment, and because Massachusetts can seize significant economic benefits by moving to a clean energy economy, the Massachusetts Global Warming Solutions Act (GWSA)[1] was signed into law in August of 2008. The major requirements of this statute include:

- Establishment of statewide GHG emissions limits,
- Implementation of a plan to achieve these statewide GHG emissions limits, and
- Requirements for the mandatory reporting of GHG emissions by larger GHG emitting sources and retail sellers of electricity in the Commonwealth.

GHGs accumulate in the atmosphere and trap heat that would otherwise be radiated back into space. This "greenhouse effect" is the primary cause of global climate change. There are a number of gases that are considered GHGs. The most prevalent greenhouse gas is carbon dioxide (CO_2), which is emitted when fuels are burned. Methane (CH_4), nitrous oxide (N_2O) and several other compounds primarily used as refrigerants are also GHGs of concern due to their potential to contribute to climate change.[2]

The GWSA established the Climate Protection and Green Economy Act in Massachusetts General Law, which requires the Massachusetts Department of Environmental Protection (MassDEP) to, among other actions, *"… determine the statewide greenhouse gas emissions level in calendar year 1990 and reasonably project what the emissions level will be in calendar year 2020 if no measures are imposed to lower emissions other than those formally adopted and implemented as of January 1, 2009. This projection shall hereafter be referred to as the projected 2020 business as usual level."* [MGL chapter 21N, section 3, subsection (a)]

The GWSA also calls upon the Executive Office of Energy and Environmental Affairs (EOEEA), in consultation with other state agencies and the public, to set an economy-wide greenhouse gas (GHG) reduction target for Massachusetts of between 10 and 25% below 1990 levels by 2020, with targets for each decade after that, culminating in at least an 80% reduction by 2050. The 2020 target must be set by January 1, 2011, and must be accompanied by an economy-wide plan to achieve that target. The 1990 emissions baseline will be the baseline against which Massachusetts' future GHG emissions reductions targets will be planned and measured.

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[1] See http://www.mass.gov/legis/laws/seslaw08/sl080298.htm

[2] Not all GHGs have the same heat-trapping capacity. For example, one ton of methane is equivalent to greater than 20 tons of CO_2 with respect to their heat trapping potentials. To account for these differences, a standard relating the heat trapping potential of each GHG to an equivalent quantity of CO_2 over a certain time period has been developed. Emissions shown in this document utilize this standard, and are expressed in units of million metric tons of carbon dioxide equivalent (CO_2e).

Section 14 of the GWSA further requires that the 1990 Baseline and 2020 Business as Usual (BAU) Projection be established by July 1, 2009. The "Statewide Greenhouse Gas Emissions Level: 1990 Baseline and 2020 Business as Usual Projection" describes the 1990 Baseline, the Massachusetts 2020 BAU Projection, and the sources of GHG emissions, data sources, and methodology used to determine the Massachusetts 1990 Baseline and the 2020 BAU Projection.

II. Public Comment Process

MassDEP solicited public comment on the 1990 Baseline and the 2020 BAU Projection, held six public meetings across the state in April and May 2009 to discuss the methodology and proposed 1990 Baseline and 2020 BAU Projection and held a public hearing on May 19, 2009. Public comments were accepted until June 1, 2009.

Following consideration of public comments received, MassDEP revised the 1990 Baseline and 2020 BAU Projection, as presented in the accompanying document. A summary of public comments received and responses to those comments are presented here.

III. Comments and Responses

A. General

Comment: One commenter requested that MassDEP integrate its state and regional requirements into any future federal legislative or regulatory programs. (Dominion)

Response: MassDEP strives to integrate state, regional and federal requirements to the extent possible. For example, MassDEP is closely following the United States Environmental Protection Agency's (EPA's) proposed GHG reporting regulation and is striving for consistency where appropriate between the Massachusetts GHG reporting regulation and the final EPA regulation. MassDEP is committed to working with EPA to ensure coordination and consistency between the state and federal GHG programs where possible and practicable. When EPA finalizes its regulations, MassDEP will consider amending related state-level regulations as appropriate to promote consistency.

B. Public Outreach

Comment: One commenter requested that MassDEP continue its public outreach efforts. (Cutting) One commenter suggested that the state needs a strong media campaign to educate citizens about the mandate to reduce emissions and how to alter their behavior to do so. (Chasen)

Response: As the Commonwealth moves forward with development of an emission limit and reduction plan for 2020, public involvement will be an important part of the process. A series of public working sessions are planned, beginning in July 2009, to involve the public in developing mitigation strategies and assessing vulnerabilities. In the summer of 2010, once limits and a plan for 2020 are drafted, the Commonwealth will again undertake a broad state-wide outreach effort to educate the public and solicit comments, as was done with the 1990 Baseline and 2020 BAU

Projection. The 2020 limit and plan will go through a formal public hearing process before becoming final by January 1, 2011.

Mass DEP maintains an extensive website (see http://www.mass.gov/dep/air/climate/) to keep the public informed about work being conducted under the GWSA and opportunities for public involvement.

C. Fixed or Amendable Baseline/BAU Projection

Comment: Three commenters agreed that the Department should set the 1990 Baseline level and not allow a moving baseline so that compliance entities have some regulatory certainty. (AIM, NEPGA, Dominion) Two commenters suggested that MassDEP revise the 2020 BAU Projection regularly so that it is a sound basis for establishing the need for, and measuring the potential success of, reduction strategies. (MAPC, MEEA) One commenter suggested that MassDEP should implement a public review process of the 1990 Baseline and the current year emissions inventories at regular three to five year intervals. This would ensure that methods, gases and sources are measured in a consistent manner as advances in measuring, montioring and tracking emissions mature, particularly with respect to ongoing research on fugitive methane emissions from natural gas distribution and SF_6 from electricity distrtibution. (NStar) One commenter supported future revisions to the GHG Inventory provided these revisions reflected improvements in terms of accuracy, consistency or ease of development and included a revision of the 1990 Baseline year. This commenter suggested that concerns that future revisions would be done as a convenient way to achieve compliance could be avoided by adjudication by an independent board or third party verifier. (Covanta)

Response: The Department recognizes that the science and practice of determining GHG emissions is changing rapidly and that Massachusetts, being at the cutting edge of this work, should avail itself of advancements in the science to the extent possible. On the other hand, the baseline must be fixed at some point so that GHG reductions can be planned and evaluated in a meaningful and consistent way.

As needed (e.g., significant new data becomes available), MassDEP will reevaluate the 1990 Baseline. If amendment is necessary, a full public review process will be used.

D. 1990 Baseline - Methodology

Comment: One commenter suggested MassDEP adopt the revised global warming potentials specified in the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report and should consider viewing GHG equivalency over the shorter 20 year time period given the Massachusetts GHG reduction goals for 2020 through 2050. (Covanta)

Response: In order to meet the long-term 2050 limit of at least an 80% reduction in GHG emissions relative to 1990, the Commonwealth will need to develop a variety of strategies, some of which will likely achieve reductions in the next few years, while others will likely achieve reductions over a longer time period. Using global warming potentials based on the 100 year time horizon is a reasonable choice for the 2020 BAU Projection because grappling with climate change will be a long-term endeavor for society. The Commonwealth will consider the short-

and long-term benefits of particular reduction strategies in developing plans to address climate change. MassDEP also notes that the 1990 Baseline and 2020 BAU Projection documentation provided on MassDEP's website ensure that the underlying data can be analyzed to investigate the effects of different global warming potentials, including 20-year global warming potentials.

E. 1990 Baseline - Data

Comment: One commenter suggested that nitrous oxide and methane emissions from "mobile combustion" sources are too high. The commenter calculated such emissions to be 0.971 $MMTCO_2e$ (using data from EPA and Energy Information Administration (EIA), and working in consultation with Northeast States for Coordinated Air Use Management (NESCAUM) staff) rather than the 1.5 $MMTCO_2e$ calculated by the Department in the public hearing draft. The difference between the two calculations is sufficiently large to have a meaningful effect on the 1990 Baseline total. (CLF)

Response: The Department has looked again at the nitrous oxide and methane emissions from the EPA SGIT Mobile Combustion module, and believes it has correctly run the module with the available default data. If the commenter could provide the source data used to calculate their emissions estimate, the Department would be pleased to look at it again in the course of reevaluating the 1990 Baseline by January 1, 2011.

Comment: One commenter noted that the commercial sector includes residential multifamily housing and may include municipal or state owned buildings (including residential), making it difficult to create effective strategies for the sector. They suggested refining what is included in the commercial sector in order to develop appropriate strategies for reducing emissions. (AIM)

Response: As AIM illustrates in the example of residential multifamily housing falling under the commercial sector, there are several areas where the data available at the sector level cross traditional policy lines. In order to address this concern and ensure that all sectors receive an equal level of attention and further that cost effective policy measures that are multi-sectoral in nature are fully considered, the composition of the policy development teams working toward the 2020 limit and plan will in many cases span sectors and will explicitly be tasked with highlighting and reporting on areas of overlap or policies with cross-sectoral implications. In the specific case of residential multifamily housing in the commercial sector, this is a known issue for the energy efficiency programs of the state's utility programs and there are efforts underway to ensure that this distinction is addressed in the current and future rounds of energy efficiency planning. In addition, commercial and residential buildings can be addressed through similar policy approaches, notably building codes and standards giving equal weight to residential and commercial buildings.

Comment: One commenter requested that MassDEP further explore ways to calculate emissions from agricultural sector activities that were not included. (Smizik) One commenter requested that agricultural fertilizer use should be included as a GHG emissions category and that omission of this category would constitute a hole in the accounting. GHG emissions data for agricultural fertilizer use in Massachusetts can be obtained by using USDA's agricultural census. (MEEA)

Response: Default SGIT fertilizer quantities and U.S. Department of Agriculture, National Agricultural Statistics Service data on the quantities of alfalfa produced in Massachusetts from 2003-2008 (see http://www.nass.usda.gov/Statistics_by_State/Massachusetts/index.asp) were used to update the SGIT Agricultural sector module.

Comment: One commenter requested that MassDEP further explore ways to calculate emissions from industrial sector activities that were not included. (Smizik) One commenter estimated that emissions from industrial wastewater treatment in pulp and paper manufacturing are less than 0.1 $MMTCO_2e$. (MCTA) One commenter suggested that non-combustion industrial source emissions in the 1990 Baseline are likely much higher than SGIT estimates due to underrepresentation of Massachusetts heavy industry in this tool. The 1990 non-combustion industrial emissions should be closer to 2.96 metric tons rather than the 0.59 metric tons estimated by SGIT. (NStar)

Response: For the revised 1990 Baseline and 2020 BAU Projection for lime and limestone, the available SGIT emissions were extrapolated to missing years (production of lime in 1990-1992 and 2001-2006, and use of limestone in 1990-1993), using a linear least-squares trend line. The 1990 Baseline and 2020 BAU Projection will be reevaluated by January 1, 2011 and the department welcomes additional detailed comments on the estimation of emissions from those with knowledge of the industrial, industrial wastewater, or any other sector.

Comment: One commenter suggested that EPA's State Greenhouse Gas Inventory Tool (SGIT) landfill default data does not match the methodology outlined in the SGIT supporting documentation. Using the methodology, the methane emissions from landfills is more than double the emissions determined with the default. MassDEP should use state specific data that has been collected in the Massachusetts Solid Waste Master Plan instead. (Covanta)

Response: The Department has replaced the SGIT defaults with Massachusetts-specific quantities of municipal solid waste combusted and landfilled. The net effect of changing both sets of defaults is decreased emissions from the solid waste sector in most years from 1990-2006.

Comment: One commenter suggested that emissions of methane from landfills are underestimated due to unrealistically high estimated methane capture efficiency of 88% relative to the potential methane generated. The US GHG Inventory reports that only 45% of methane generated from landfills is collected and destroyed. The EPA's AP-42 default collection efficiency is 75%. Landfills may not be able to achieve the high collection efficiency of 88%. MassDEP should defer to the accepted default collection efficiency of 75% after a collection system is in place. (Covanta) One commenter suggested that emissions from waste to energy (WtE) facilities are overestimated because of flaws in EPA's methodology and assumptions on which SGIT is based, and provides alternative annual emissions estimates. These estimates are based on a methodology for calculating non-biogenic CO_2 emissions based on quantity of municipal solid waste (MSW) combusted, EPA's F_c fuel-specific emission factor, the average MSW higher heating value and the representative biogenic CO_2 fraction in the WtE flue gas. This method is consistent with The Climate Registry Electric Power Sector Protocol which Massachusetts requires facilities to use in its GHG Reporting rule. (Covanta) One commenter noted that EPA's SGIT data for its N_2O emission factor is based on older sources resulting in the

44g/metric ton of MSW emission factor rather than the 12g/metric ton MSW emissions factor resulting from recent US test data. (Covanta)

Response: MassDEP does not have state specific data on methane capture efficiency or CO_2 or N_2O emissions from landfills or municipal waste combustion facilities. Deferring to the EPA SGIT model ensures that Massachusetts data will be calculated in a consistent manner with other national and state level greenhouse gas inventories. If this model is updated and these emission methodologies change in the future, MassDEP will consider updating the 1990 Baseline and 2020 BAU Projection accordingly.

F. 2020 BAU Projection – Methodology

Comment: One commenter suggested that the creation of high/low range projections rather than a sum of sector-specific standard deviations will better capture the interrelatedness of sectors and correlation of emissions across sectors. (ENE)

Response: The Department has revised the way it calculated the standard deviation to estimate the volatility in the historic data in order to better project the probability range for the 2020 high and low range projections, for both the overall BAU projection and separately for projections by sector, particularly for the electric sector. Instead of the proposed approach of separately calculating and summing the standard deviation of the GHG emissions associated with each sector, the revised standard deviation has been calculated based on the total statewide gross emissions. Sector by sector standard deviations for projections are also available in Appendix I.

For all sectors, the projection approach has been modified to more rigorously take into account the statistical limitations imposed by the number of available data points and to present a range that represents 50% confidence that expected emissions lie within the range.

Comment: Three commenters expressed concerns that the 2020 BAU Projection does not take into account significant policy changes adopted prior to January 1, 2009. The policy changes mentioned include: the Regional Greenhouse Gas Initiative (RGGI); renewable energy and energy efficiency provisions of the Massachusetts Green Communities Act; Renewable Portfolio Standards (RPS); and commitments from the Governor's Office such as Executive Order (EO) 484 "Leading by Example – Clean Energy and Efficient Buildings" and the Commonwealth Solar and Wind programs. These projects should be taken into account so that the BAU scenario will not be achieved by what is already mandated under existing law. (CLF, ELM, MCAN) One commenter requested that MassDEP not include the Regional Greenhouse Gas Initiative (RGGI) or federal climate change programs in the 2020 BAU Projection since the electric sector in Massachusetts has already done its share of reductions. (Dominion)

Response: The language in the statute states that the Department should incorporate policies at the state and federal level that have been implemented by January 1, 2009. The Department's approach to the BAU is to base the projections on the historical data, and at the time that we made the BAU available for public comment, that approach precluded us from taking into account policy impacts on emissions in years 2006-2008, because most of the emissions data were not available beyond 2005. For the revised 1990 Baseline and 2020 BAU Projection, the Department has used the most recent raw data available on the consumption of fuels from the US

Department of Energy's Energy Information Administration. Therefore, the revised 2020 BAU Projection includes emissions for the energy sector through 2007 and for the Electric Power potion of the energy sector though 2008, thereby implicitly incorporating the impact of policies in place through those time periods. In addition, the Department is anticipating reevaluating the 2020 BAU Projection between now and January 1, 2011 when the 2020 limit will be set. By then, the Department anticipates having data through 2008 for most sectors reported, and through 2009 for the electricity sector which is most affected by RPS, energy efficiency, EO484 and Commonwealth Solar.

MassDEP would like to clarify that Massachusetts' membership in the RGGI GHG cap and trade program does not represent a cap on power plant emissions in Massachusetts. Due to the regional nature of the program and the emphasis on trading to maximize economic efficiency, there is no accurate way to project the impact that RGGI will have on the volume of Massachusetts emissions. RGGI may affect the average emissions factor of generation in the region, and to that extent the impact of the early years will be captured in our electricity data beginning in 2009; however, the reality is that the current economic downtown is likely to mean that any signal from RGGI will be difficult to separate out given the lack of a tightly binding cap during this period (i.e., prior to annual reductions in the RGGI cap beginning in 2015 and culminating in a 10% reduction in 2018). While the 2020 BAU Projection could be modified to subtract 2.5% of electric sector emissions in 2015, 5% in 2016, 7.5% in 2017 and 10% in 2018 through 2020, there is no enforceable requirement that the emissions associated with the electricity consumed in Massachusetts decrease by these amounts; thus, such a modification may artificially deflate the projection.

Comment: One commenter suggested that the BAU projection for the transportation sector be revised because the transportation emissions projection shows an unrealistically sharp increase in GHG emissions for that sector. The BAU for this sector should reflect the recent downward trend in vehicle miles traveled (VMT), use of public transportation, and particularly the significant (even post 1/1/09) federal clean car commitments. The commenter felt that the 2020 BAU Projection would be obsolete were the federal "clean car" commitments to be excluded. (CLF)

Response: While there have been downward trends in VMT at the federal level, the same data from the Federal Highway Administration http://www.fhwa.dot.gov/ohim/tvtw/tvtpage.cfm show that the trend in VMT in Massachusetts has been essentially flat over the period from 2003 to March 2009. Similar to RGGI, the federal corporate average fuel economy (CAFE) standards set no particular parameters for Massachusetts, and the fleet composition in Massachusetts differs from the US total, so it is not clear how to quantify how much influence CAFE has or a revised CAFE will have on Massachusetts mobile emissions. Furthermore, recent changes in the CAFE standards by the Obama administration are too recent to be included in the BAU projection under the guidance provided by the GWSA legislation. Instead of including these measures in the BAU forecast, the Department plans to take account of potential changes due to CAFE in the projections based on policy changes in the January 1, 2011 plan for 2020, by which time the impacts on fleet mix and fuels may be more apparent.

Comment: Two commenters suggested that MassDEP use historical average emissions (of 2005-2007 or two highest emissions years in past five) as the starting point for projecting electric sector emissions for the 2020 BAU Projection rather than 2008 because 2008 consumption was abnormally low. (NEPGA, Dominion)

Response: The Department believes that not enough time has passed since 2008 to know whether 2008 will be seen as abnormal. Therefore, the Department believes it is appropriate to use all the most recent data available in projecting future emissions. The revised electric sector projection is based on an annual log growth projection using all electric sector data available, which includes 1990 through 2008.

G. 2020 BAU Projection – Data

Comment: One commenter suggested that the mid-range scenario for the 2020 BAU Projection should be modified downward slightly to reflect most recent transportation data. Energy Information Administration (EIA) data shows a decline in gasoline and diesel fuel consumption (the proxy used for determining transportation emission) since 2005. This recent trend in transportation emissions is substantially different than the ending years (2002-2005) used for the 2020 BAU Projection. (ENE)

Response: The proposed 2020 BAU Projection was based on the default data contained in EPA's State GHG Inventory Tool (SGIT), which extended through 2005 for most sectors. The revised 1990 Baseline and 2020 BAU Projection incorporate the most recent updates available from the Department of Energy's Energy Information Administration, which extend through 2007 for fossil fuel combustion (see http://www.eia.doe.gov/emeu/states/_seds_updates.html) and through 2008 for the Electric Power portion of fossil fuel combustion (see http://www.eia.doe.gov/cneaf/electricity/epm/epm_ex_bkis.html).

Comment: One commenter suggested that the projected increases in industrial emissions are too high and that the assumptions for the projection of ozone depleting substance (ODS) substitute emissions are flawed and should be revisited. (MCTA)

Response: The 2020 BAU Projection will be reevaluated by January 1, 2011 and the Department welcomes additional detailed comments on the projections of emissions from ODS substitutes. The general approach of estimating future growth based on historical data creates particular challenges for this sector, given the unusual growth in this sector due to the impact of the 1990 Montreal protocol. As a result, the Department has already moderated growth projections by using only the more recent portion of the historical data to trend future emissions.

Comment: One commenter noted that SF_6 equipment is likely to be added to the inventories of electric transmission and distribution operations unless a suitable substitute becomes available. (NStar)

Response: For the revised 1990 Baseline and 2020 BAU Projection, the proposed forecast for SF_6 emissions has been retained. However, the 2020 BAU Projection will be reevaluated by January 1, 2011 and the Department welcomes additional detailed comments on the projections

of emissions from electric transmission companies and others with knowledge of this sector based on known and predicted growth in this area.

H. Emissions from Electricity Sector

Comment: Two commenters requested that MassDEP use a regional approach to calculate the emissions for electricity consumed in Massachusetts based on the emissions data for the overall New England grid, in addition to the proposed methodology. The Massachusetts Department of Public Utilities (DPU) points out that due to the linked, regional nature of the New England electric grid, electricity generated in a state is not necessarily consumed in that state, even if that state is a net importer of electricity. (DPU, ISO-NE)

Response: MassDEP appreciates these comments, and agrees that it is useful to consider GHG emissions associated with electricity consumption in regional and more state-specific contexts. The strategies chosen to reduce GHG emissions as part of the Commonwealth's 2020 (and beyond) plans will benefit from keeping in mind this inherent property of the electric grid, as the effectiveness of GHG reduction strategies may vary based on whether or not it is assumed that all electricity generated in-state is consumed in-state.

This 1990 Baseline and 2020 BAU Projection presents emissions associated with electricity consumption using an approach that more directly accounts for emissions associated with electricity generated in Massachusetts, while an alternative regional approach is discussed further below and documented in the Appendix I spreadsheet to the 1990 Baseline and 2020 BAU Projection. The 1990 Baseline and 2020 BAU Projection approach assumes that all electricity generated in Massachusetts is used in Massachusetts. Thus, electric sector emissions in this approach are based on emissions from Massachusetts power plants plus a portion of emissions from power plants in the other New England states that generate more electricity than they use in a given year and in the adjacent control areas (New York, New Brunswick, Quebec) in years that New England received net imports of electricity from those control areas. This approach is consistent with the methodology of the EPA SGIT tool and the World Resources Institute reporting protocols which ask for tracking of generation emissions in the control area (scope 1) and separate tracking of electricity imports (scope 2), and thus facilitates comparison of the Commonwealth with the GHG emissions inventories of other states.

An alternative electricity consumption emissions approach involves first determining the fraction of New England electricity (in MWh) that is consumed in Massachusetts. Massachusetts is then assumed to be responsible for that same fraction of the GHGs emitted while generating that electricity. Thus, electric sector emissions in this approach are based on the total New England GHG emissions from electricity generation, irrespective of the generation fuel mix in Massachusetts, plus GHG emissions associated with electricity imported from the adjacent control areas (New York, New Brunswick, Quebec) in years that New England received net imports of electricity from those control areas; this total was multiplied by the ratio of Massachusetts to New England electricity consumption. This approach is documented on the far right of the ElecImport tab of Appendix I and will be considered as the 2020 emission reduction target and plan are developed.

Comment: One commenter requested that MassDEP use actual continuous emissions monitoring system (CEMS) CO_2 emissions data, reported to EPA's Clean Air Markets Division (CAMD), instead of EPA's State Greenhouse Gas Inventory Tool (SGIT) for 2006, 2007, and 2008 so that Massachusetts data will correlate to data reported to CAMD for each generating unit. The commenter agreed with the Department's efforts to develop an estimate of imported electricity emissions but requested that the Department review its methodology for calculating these emissions to see if this could be the source of conflict between SGIT and CEMS data. (Dominion)

Response: Facilities that report CO_2 emissions data to EPA's CAMD are a subset of the universe of electric power facilities in Massachusetts that are included in EPA's SGIT. In 2006, 2007 and 2008 the EPA CAMD data includes CO_2 emissions from units in Massachusetts that were subject to the federal Acid Rain Program. In contrast, the SGIT data for those years is calculated from all coal, petroleum and natural gas burned by large Massachusetts electric power facilities, including Acid Rain units and non-Acid Rain units. A comparison of the data for these years shows that the amount of CO_2 calculated for each year by the EPA SGIT tool is greater than the amount of CO_2 reported in each year to EPA's CAMD, as would be expected due to the greater number of facilities included in the SGIT electric sector. MassDEP believes that the SGIT tool correlates with the data reported to CAMD, and will continue to utilize the CAMD data when appropriate in analyzing emissions.

I. Biomass/Bioenergy/Biogenic Emissions

Comment: One commenter suggested that MassDEP establish a baseline for net GHG emissions as well as gross GHG emissions. A net GHG emissions baseline would take into account sequestration as well as actual GHG emissions. This approach would include the extent to which GHG emissions are absorbed by forests and other vegetation in Massachusetts and also the emissions associated with land use changes in Massachusetts, including the loss of carbon sequestration capacity. The net emissions figure could be adjusted once more reliable and/or comprehensive data is available regarding carbon uptake by vegetated landscapes. (CLF) One commenter suggested that MassDEP account for forest carbon and emissions in imported electricity, especially where biomass constitutes a significant portion of the renewable generation. This should include the impacts of burning forest biomass and also of burning construction and demolition debris which is a significant source of biomass fuel in Maine. (MEEA) One commenter requested that MassDEP maintain consistency with national and international carbon accounting principals, particularly with respect to forestry activities and biomass burning. (MEEA) Two commenters suggested that MassDEP account for the net carbon emissions of bioenergy and particularly include the impact of woody biomass energy on carbon sequestration rates of Massachusetts forests. This would allow Massachusetts to develop clear standards for the careful and selective management of forests so as to maintain a relatively constant or increasing rate of carbon sequestration. (MAudubon) (MEEA) One commenter suggested that the biogenic CO_2 emissions from biomass combustion be tracked separately for informational purposes. (Covanta) One commenter suggested MassDEP estimate biogenic CO_2 emissions generated from significant producers to ensure the state's ability to address policy questions such as whether ethanol in fuel is a net benefit. They suggest that emissions from ethanol fuel could be estimated from gas station sales receipts, and that waste to energy biogenic CO_2 emissions could be estimated using either historic monitoring reports or emission factors.

(MAPC) One commenter indicated that several data sets exist with information on Massachusetts' forests and carbon sequestration to enable development of a comprehensive solution that considers net carbon impact. (Smizik)

Response: The 1990 Baseline and 2020 BAU Projection has been revised to document biogenic sources and sinks in line with the general scope-based approach to reporting GHG emissions adopted by the World Resources Institute, The Climate Registry, and others, which report biogenic CO_2 emissions separately from other GHG emissions.

In line with the comments received, this revision better reflects biogenic sources and sinks. These emissions include the biogenic CO_2 emissions from burning biomass, including: biofuels such as ethanol; wood- and paper-fired electric generation; and, the biomass component of waste to energy plants. In addition, the value of forested lands as a carbon sequestration sink and the carbon released due to forest land lost annually to land use change have been documented. To the extent that biomass harvested due to land-use change in Massachusetts is also combusted in Massachusetts, such emissions are double-reported in Table 2 in Combustion and Land Use Change emissions. It should also be noted that the inclusion of GHG sinks only from forestry represents a substantial but not complete set of carbon sinks in the state, and that annual forest sink data points for many years are based on interpolated rather than measured data. Despite the challenges in accurately calculating this data on an annual basis, it appears that the data available for the biomass sector are sufficient, and their magnitude is significant enough that it is important to track going forward. For these reasons, and for the purposes of legal compliance with the 2020 limit to be established, the gross emissions numbers from fossil rather than emissions net of biogenic sources shall be the primary point of reference.

J. Carbon Sequestration Sinks & Emissions from Land Use Conversion

Comment: One commenter suggested that MassDEP assign a non-zero value for net emissions related to land use change for the 1990 Baseline and 2020 BAU Projection, and that there is adequate data available to do so. (ENE) Three commenters suggested that there is sufficient data to include the sources of carbon emissions due to loss of GHG sink capacity due to land use conversion. (TNC, MAPC, PFT) One commenter suggested that the 2006 study "Forest harvesting and land-use conversion over two decades in Massachusetts" by R.I. McDonald, M.S. Bank, J. Burk, D.B. Kittredge, G. Motzkin, and D.R. Foster shows that smaller parcels of forest are more vulnerable to conversion. In Massachusetts, over 220,000 private landowners hold 78% of the forested lands in the state, creating vulnerability and opportunity, and possibly significant policy implications. (TNC) Four commenters suggested data sources the Department could use to calculate GHG emissions that are absorbed each year by Massachusetts forests and vegetated landscapes. These sources include: US Forest Service's Forest Inventory and Analysis (FIA) program, MassGIS Land Use/Land Cover data, Massachusetts Audubon's "Losing Ground" series; the 2006 IPCC Guidelines for National Greenhouse Gas Inventories; Agriculture, Forestry, and Other Land Use, Vol. 4. (TNC, CLF, PFT, ENE) One commenter suggested that there is sufficient data to include the carbon sinks of Massachusetts urban and rural forests and notes that the 2007 study "Terrestrial Carbon Sequestration in the Northeast: Quantities and Costs" by The Nature Conservancy, Winrock International and The Sampson Group indicates a very significant carbon sink of approximately 15 $MMTCO_2e$ in Massachusetts. (TNC) Three commenters suggested that MassDEP fully account for the "carbon sink" value of

forested and vegetated (including agricultural) landscapes in Massachusetts. (CLF, ELM, MAudubon, PFT) One commenter suggested that MassDEP include a yearly accounting for forest carbon stocks that includes the effects of harvesting activities as an immediate and direct source of GHG emissions and forest growth as a carbon sink. (MEEA) Three commenters suggested data sources the Department should consider with respect to carbon sinks: the report "Terrestrial Carbon Sequestration in the Northeast: Quantities and Costs" by The Nature Conservancy, Winrock International and The Sampson Group; and Harvard Forest's research on carbon sequestration, Hubbard Brook Research Station and Clark University. (TNC, MAudubon, PFT) One commenter suggested the use of the US Forest Service's Vegetation Simulator Tool as a way to provide forest and land use data for the 1990 Baseline and 2020 BAU Projection. (MEEA)

Response: The data sources submitted in comments were helpful and the Department worked with US Forest Service, MassGIS and Harvard Forest data to develop estimates in the 1990 Baseline and 2020 BAU Projection documenting forest sequestration and land use change. The Department appreciates that sequestration and land use change are areas of emerging knowledge and data reporting and looks forward to further input on the methodology between now and 2011.

K. Embodied Emissions

Comment: Two commenters agreed with the Department that the embodied emissions generated from products coming into Massachusetts should not be included in the baseline calculation since there is still great uncertainty in the data. (Dominion) (AIM) One commenter suggested that MassDEP include embodied emissions to avoid policy bias toward solutions that shift production out of state, especially where other states are not also participating in a similar accounting process. Emissions estimates should be adjusted based on how Massachusetts consumption rates differ from the national norm. (MAPC) One commenter suggested that TURA reporting be expanded to track embedded emissions and energy use emissions. (Allen) One commenter suggested that mandated greenhouse gas reductions will result in a net increase in worldwide CO_2 emissions as businesses and operations move out of state driven by resulting high energy costs. (AIM)

Response: As Massachusetts has moved away from manufacturing and toward a service economy, and has produced less of its own food, it is reasonable to assume that the GHG emissions "imported" in these goods from other states and countries has risen. Since, in general, service sectors are less energy-intensive than manufacturing sectors, it is likely that the net balance of imported over exported GHG emissions has risen. The fact that manufacturing processes in some countries that export heavily to the U.S., such as China, are known to be GHG-intensive, contributes to this trend.

However, the science of estimating these effects is only in its beginning stages at the national level. A few academic studies have attempted to quantify emissions embodied in imports to the United States, but MassDEP is not aware of any that have yet done so at the state level. At the national level, the estimates made in these studies acknowledge a wide range of uncertainty in their results. In addition, much of the data needed to extend these results to the state level are lacking. For example, while data exists on production of manufactured goods by industry in

Massachusetts, data on consumption of such goods is not available. Detailed data on imports of such goods to the state by industry, or where the imports come from, is also not available. At best, MassDEP can only make rough extrapolations from national data. Further, the available academic studies do not have data for our base year of 1990. One study presents data only for 1997 and 2004, making it difficult to extrapolate backward to 1990. Nor are there good forecasts of where manufacturing will take place in 2020, what Massachusetts consumption will be in that year, or what the carbon intensity factors will be in future years for each industry, in each country and state.

For these reasons, MassDEP cannot make reasonable estimates of net GHG imports to the Commonwealth in 1990, nor project them to 2020. However, because of the importance of such impacts, and possible future policy options that could address this, MassDEP will continue to track research in this area. If it becomes possible to make reasonably accurate estimates of net GHG imports for a recent year, or some future year, MassDEP will attempt to estimate incremental changes in such imports over future time periods.

Comment: Two commenters suggested that the report misrepresents Waste to Energy (WtE) as a significant contributor to GHG and recommended that the Department use a life cycle approach that acknowledges WtE as a GHG mitigation tool and takes into account the GHG emissions avoided by WtE. Others, such as EPA's Municipal Solid Waste Decision Support Tool, IPCC, World Economic Forum, the European Union, and the Kyoto Protocol, recognize WtE's role in reducing GHG emissions. (ERC, Covanta)

Response: If the purpose of the1990 Baseline and 2020 BAU Projection were to quantify the benefits of waste to energy facilities, then a life cycle approach could be appropriate. However, the purpose of the 1990 Baseline and 2020 BAU Projection is to document historical emissions and provide a sense of what emissions might be in the near future. As part of the work to develop the 2020 emissions limit and plan by January 1, 2011, it may be appropriate to consider models, such as those mentioned by the commenters, in order to understand the tradeoffs between various possible future strategies.

Comment: One commenter suggested that MassDEP should account for GHG emissions from waste generated by Massachusetts residents and exported outside of the state. This transport and disposal of wastes out of state would qualify as leakage and should be reported as such unless GHG emissions associated with waste generated in the state are reported. Excluding this waste from the inventory provides an incentive to export more waste out of the state in the future. (Covanta)

Response: While it is true that out-of-state landfills and municipal waste combustors that receive waste from Massachusetts generate greenhouse gases in a manner similar to in-state disposal facilities, the only out-of-state emission sector mandated to be included by the GWSA was electricity generation. The issue of how Massachusetts addresses solid waste disposal has been and will continue to be addressed as part of the state's Solid Waste Master Plan, which will be closely coordinated with GHG mitigation plans being developed under GWSA.

L. Emissions of Indirect GHG

Comment: One commenter encouraged MassDEP to include indirect GHG emissions (CO, NO_x, NMVOCs and SO_2) in the inventory. These gases indirectly affect terrestrial radiation absorption. EPA's 1990-2007 Inventory of GHG Emissions and Sinks document indicate that such reporting is now considered best practice. (MEEA)

Response: MassDEP tracks such emissions due to their status as criteria pollutants which must meet National Ambient Air Quality Standards. If it becomes necessary to control these gases due to their association with climate change, the Department already maintains a rich emissions inventory upon which to draw.

M. Reduction Plan/Strategies

Comment: One commenter suggested that the Department consider the investments already made in the electricity sector when setting reduction targets going forward. (NEPGA)

Response: Emission reduction strategies for all sectors of the economy will be considered in light of improvements already made and the potential for further reductions.

Comment: One commenter suggested that the state has had a fairly constant level of GHG with little effort and calls for aggressive reduction goals. No need to wait till January 1, 2011 to set 2020 targets. (MCAN)

Response: The Commonwealth agencies are engaged in a planning process to determine appropriate emissions limits for 2020 and to develop a balanced, economy-wide plan for achieving them. The process will include extensive opportunities for stakeholder and public involvement. Ultimately, the limits and plan will be the subject of a public comment period and hearing. It is anticipated that this process, done thoroughly and well, will take the time allotted until January 1, 2011 to complete.

Comment: One commenter suggested that MassDEP calculate and analyze emissions based on "systems" in addition to "sectors" to better account for emissions from materials, products, waste, and land management. (Allen)

Response: In developing the plan to meet the 2020 limit, there may be certain strategies that will benefit from a "systems" or "life cycle" analysis, in cases where the necessary supporting information is available.

Comment: One commenter suggested that the use of the RPS certificates for biomass should be carefully examined due to evidence of clear cutting that is occurring, eliminating carbon sinks. (Chasen)

Response: As part of establishing the 2020 emissions limit, the impact of particular strategies will be considered. The Massachusetts Department of Energy Resources will continue to be involved in determining the role of the RPS program in meeting the Commonwealth's GHG reduction goals.

IV. Summary of Changes

The changes discussed in this Response to Comments document result in the following changes to the 1990 Baseline.

Comparison of Public Comment Draft (April 09) and Revised 1990 Baseline (July 09) ($MMTCO_2e$)

	Draft 1990 Baseline	Revised 1990 Baseline
Energy Total	**90**	**89.8**
CO_2 from Fossil Fuel Combustion	84	83.9
Residential CO_2	15	15.0
Commercial CO_2	8	8.4
Industrial CO_2	6	6.0
Transportation CO_2	29	28.9
Electric Generation CO_2	26	25.6
Electricity Imports CO_2, CH_4, N_2O	2.4	2.0
Other Gases Total	3.8	3.8
Stationary Combustion	0.4	0.4
Electric Power	0.1	0.1
Other	0.3	0.3
Mobile Combustion	1.5	1.5
Natural Gas and Oil Systems	1.9	1.9
Industrial Processes	**0.6**	**0.7**
Agriculture	**0.3**	**0.4**
Waste	**4.7**	**3.6**
Gross Emissions	**96**	**94.4**

Note: due to rounding to 1 decimal place, the energy total of 89.8 appears higher than a simple sum of the sectors shown in table 1 (89.7), and for the same reason, the Gross Emissions total of 94.4 appears lower than the sum of the bolded numbers (94.5).

V. List of Commenters

Associated Industries of Massachusetts (AIM)
Conservation Law Foundation (CLF)
Covanta Energy (Covanta)
Dominion Resource Services, Inc. (Dominion)
Energy Recovery Council (ERC)
Environment Massachusetts, Elizabeth Collins and Ben Wright
Environmental League of Massachusetts (ELM)
Environment Northeast (ENE)

General Electric Aviation Lynn, MA (GE)
ISO New England Inc. (ISO-NE)
Mass Audubon (MAudubon)
Massachusetts Chemistry & Technology Alliance, Inc. (MCTA)
Massachusetts Department of Public Utilities (DPU)
Massachusetts Environmental Energy Alliance (MEEA)
Massachusetts Representative Frank I. Smizik (Smizik)
Metropolitan Area Planning Council (MAPC)
New England Power Generators Association, Inc. (NEPGA)
NStar (Nstar)
The Nature Conservancy (TNC), Stephen Long
The Pacific Forest Trust (PFT), Emily Russel-Roy
Doroth Allen (Allen)
Andrea Chasen (Chasen)
Peter Cutting (Cutting)
Fred Schlicher, Mass Climate Action Network (MCAN)